Listing of Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

1-18 (canceled)

19. (currently amended) A computer readable media including a control program, according to which a laser-beam spot is guided, while being controlled with respect to position and time, over a cornea to be corrected, so as to ablate a predetermined ablation profile therefrom, comprising:

~~wherein the control program~~ instructions to take[[s]] into account the effect of the angle between the laser beam (68) and the corneal surface on the energy density of the laser-beam spot incident on the corneal surface,

wherein the time interval the laser-beam spot is incident on the corneal surface at an incident point (58) of the corneal surface is increased as a function of the distance (r) of the incident point (58) of the laser-beam spot centre on the cornea (54) from an axis running parallel to the laser-beam direction which axis meets the corneal surface at a right angle (z axis),

wherein the effect of the distance r of the incidence point (58) of the laser-beam spot centre on the cornea (54) from an axis running parallel to the laser-beam direction which meets the corneal surface at a right angle (z axis), is taken into account, and account is taken of the fact that the energy density F of the emitted laser-beam spot of radius r_s is reduced to F/kl(r), in the case of a cornea assumed to be hemispherical with radius R, when incident on its curved surface (54), where

$$k1(r) = \frac{A_{eff}(r)}{A_0} = \frac{A_{eff}(r)}{\pi \cdot r_s^2}$$

and

$$A_{eff}(r) = \int_{-rs}^{rs} \int_{\sqrt{rs^2 - x^2} + r}^{\sqrt{rs^2 - x^2} + r} \sqrt{1 + \left(\frac{d}{dx} f(x,y)\right)^2 + \left(\frac{d}{dy} f(x,y)\right)^2}\, dxdy$$

with

$$z = f(x,y) = f(r) = \sqrt{R^2 - x^2 - y^2} = \sqrt{R^2 - r^2},$$

$r = (x^2 + y^2)^{½}$

where x, y, z are the coordinates of the incidence point (58) of the laser-beam spot centre in a Cartesian coordinate system, in which the origin lies at the sphere centre of the cornea which is assumed to be hemispherical.

20. (currently amended) ~~Control program~~ <u>The computer readable media</u> according to claim 19, wherein the formula is applied for the ablation depth achieved owing to a particular laser-beam spot pulse, in that it is reduced to d·kor1(r) in relation to the ablation depth d in the case of normal incidence of the laser-beam spot when the laser-beam spot is incident on the curved surface (54), where

$$kor1(r) = \frac{\ln\left(\frac{F}{k1(r)F_{th}}\right)}{\ln\left(\frac{F}{F_{th}}\right)}$$

and F_{th} is the energy-density threshold above which ablation takes place, and in that, when generating the control program, this formula is used to adjust the control of the laser beam in accordance with the desired ablation depth.

21. (currently amended) ~~Control program~~ The computer readable media according to claim 19 wherein account is also taken of the fact that a fraction of the laser-beam energy incident on the corneal surface is reflected away.

22. (currently amended) ~~Control program~~ The computer readable media according to claim 19, wherein account is taken of the fact that, in the case of the cornea assumed to be hemispherical, the unreflected fraction of the energy density F/k1(r) of the laser-beam spot incident on the curved surface is given as (1-k2(r))·F/k1(r), where

$$k2(r) = \frac{q_\perp^2(r) + q_\parallel^2(r)}{2}$$

with

$$q_\perp(\alpha_1) = \frac{\sqrt{n^2 - \sin^2(\alpha_i)} - \cos(\alpha_i)}{1 - n^2}$$

$$q_\parallel(\alpha_1) = \frac{n^2 \cos(\alpha_i) - \sqrt{n^2 - \sin^2(\alpha_i)}}{n^2 \cos(\alpha_i) + \sqrt{n^2 - \sin^2(\alpha_i)}}$$

where $\pi/2-\alpha_1$ is the angle between the laser beam and the corneal surface, where

$$\alpha_1(r) = a\tan\left(\frac{r}{\sqrt{R^2 - r}}\right)$$ with $0 \leq r^2 < R^2$.

and n is the empirically determined refractive index of the cornea at the wavelength of the laser beam which is used.

23. (currently amended) ~~Control program~~ The computer readable media according to claim 21, wherein the formula is applied for the ablation depth due to a particular laser-beam spot pulse, in that it is reduced to d·kor(r) in relation to the ablation depth d in the case of normal incidence of the laser-beam spot when the laser-beam spot is incident on the curved surface (54), where

$$kor(r) = \frac{\ln\left(\frac{(1-k2(r)) \cdot F}{k1(r) \cdot F_{th}}\right)}{\ln\left(\frac{F}{F_{th}}\right)}$$

and F_{th} is the energy-density threshold above which ablation takes place, and in that, when generating the control program, this formula is used to adjust the control of the laser beam in accordance with the desired ablation depth.

24. (canceled)

25. (currently amended) A computer readable media including a [[C]]control program, according to which a laser-beam spot is guided, while being controlled with respect to position and time, over a cornea to be corrected photorefractively, so as to ablate a predetermined ablation profile therefrom, comprising:

~~wherein the~~ instructions to take into account the effect of the angle between the laser beam and the corneal surface on the fraction of the laser-beam energy incident on the corneal surface which is reflected away ~~is taken into account~~,

wherein the effect of the distance r of the incidence point (58) of the laser-beam spot centre on the cornea from an axis running parallel to the laser-beam direction, which meets the corneal surface at a right angle (z axis) is taken into account, ~~and~~

wherein account is taken of the fact that, in the case of the cornea assumed to be hemispherical with radius R, the unreflected fraction of the energy density F of the laser-beam spot incident on the curved surface is given as (1-k2(r))·F, where

$$k2(r) = \frac{q_{\perp}^2(r) + q_{\parallel}^2(r)}{2}$$

with

$$q_{\perp}(\alpha_1) = \frac{\sqrt{n^2 - \sin^2(\alpha_i)} - \cos(\alpha_i)}{1 - n^2}$$

$$q_{\parallel}(\alpha_1) = \frac{n^2 \cos(\alpha_i) - \sqrt{n^2 - \sin^2(\alpha_i)}}{n^2 \cos(\alpha_i) + \sqrt{n^2 - \sin^2(\alpha_i)}}$$

where $\pi/2-\alpha_1$ is the angle between the laser beam and the corneal surface, where

$$\alpha_1(r) = a\tan\left(\frac{r}{\sqrt{R^2 - r}}\right) \quad \text{with } 0 \leq r^2 < R^2.$$

and n is the empirically determined refractive index of the cornea at the wavelength of the laser beam which is used.

26. (currently amended) ~~Control program~~ The computer readable media according to claim 25, wherein the formula is applied for the ablation depth due to a particular laser-beam spot pulse, in that it is reduced to d·kor2(r) in relation to the ablation depth d in the case of normal incidence of the laser-beam spot when the laser-beam spot is incident on the curved surface, where

$$kor2(r) = \frac{\ln\left(\frac{(1 - k2(r)) \cdot F}{F_{th}}\right)}{\ln\left(\frac{F}{F_{th}}\right)}$$

and F_{th} is the energy-density threshold above which ablation takes place, and in that, when generating the control program, this formula is used to adjust the control of the laser beam in accordance with the desired ablation depth.

27-31. (canceled)

32. (withdrawn) Device for photorefractive corneal surgery of the eye to correct sight defects, having:

- an instrument (12, 14, 16, 22, 24, 28) for measuring the entire optical system of the eye to be corrected,
- means (48) for deriving an ablation profile from the measured values,
- a laser-radiation source (30) and means (32, 38, 40, 48) for controlling the radiation in accordance with the ablation profile, characterised in that the control means comprise an electronic computer (48) which runs a control program according to one of claims 1, 18 to 34.

33-43. (canceled)

44. (new) A computer readable media including a control program according to which an intensity of a laser-beam is controlled, while being controlled with respect to position and time, over a cornea to be corrected, comprising:

instructions for determining a reduction in an energy density of the laser-beam incident on a corneal surface due to an angle between the laser beam and the corneal surface;

instructions for determining a fraction of the laser-beam energy incident on the corneal surface that is reflected away; and

instructions for adjusting the intensity in response to the determined fraction and reduction;

wherein the time interval the laser-beam spot is incident on the corneal surface at an incident point of the corneal surface being increased as a function of the distance of the incidence point of the laser-beam spot center of the cornea from an axis running parallel to the laser-beam direction which axis meets the corneal surface at a right angle;

wherein the energy density F of the emitted laser-beam spot of a radius r_s is calculated as being reduced to F/k1(r), in the case of a cornea assumed to be

substantially hemispherical with radius R, when incident on its curved surface (54), where

$$k1(r) = \frac{A_{eff}(r)}{A_0} = \frac{A_{eff}(r)}{\pi \cdot r_s^2}$$

and

$$A_{eff}(r) = \int_{-rs}^{rs} \int_{\sqrt{rs^2 - x^2} + r}^{\sqrt{rs^2 - x^2} + r} \sqrt{1 + \left(\frac{d}{dx} f(x,y)\right)^2 + \left(\frac{d}{dy} f(x,y)\right)^2}\, dxdy$$

with

$$z = f(x,y) = f(r) = \sqrt{R^2 - x^2 - y^2} = \sqrt{R^2 - r^2},$$

$$r = (x^2 + y^2)^{1/2}$$

where x, y, z are the coordinates of the incidence point (58) of the laser-beam spot centre in a Cartesian coordinate system, in which the origin lies at the sphere centre of the cornea.

45. (new) A computer readable media including a control program according to which an intensity of a laser-beam is controlled, while being controlled with respect to position and time, over a cornea to be corrected, comprising:

instructions for determining a reduction in an energy density of the laser-beam incident on a corneal surface due to an angle between the laser beam and the corneal surface;

instructions for determining a fraction of the laser-beam energy incident on the corneal surface that is reflected away; and

instructions for adjusting the intensity in response to the determined fraction and reduction;

wherein the time interval the laser-beam spot is incident on the corneal surface at an incident point of the corneal surface being increased as a function of the distance of the incidence point of the laser-beam spot center of the cornea from an axis running parallel to the laser-beam direction which axis meets the corneal surface at a right angle;

wherein an unreflected fraction of the energy density F of the laser-beam spot incident on the curved surface is calculated by the formula (1-k2(r))·F, where

$$k2(r) = \frac{q_{\perp}^{2}(r) + q_{\parallel}^{2}(r)}{2}$$

with

$$q_{\perp}(\alpha_1) = \frac{\sqrt{n^2 - \sin^2(\alpha_i)} - \cos(\alpha_i)}{1 - n^2}$$

$$q_{\parallel}(\alpha_1) = \frac{n^2\cos(\alpha_i) - \sqrt{n^2 - \sin^2(\alpha_i)}}{n^2\cos(\alpha_i) + \sqrt{n^2 - \sin^2(\alpha_i)}}$$

where $\pi/2-\alpha_1$ is the angle between the laser beam and the corneal surface, where

$$\alpha_1(r) = a\tan\left(\frac{r}{\sqrt{R^2 - r}}\right) \quad \text{with } 0 < r^2 < R^2.$$

and n is the empirically determined refractive index of the cornea at the wavelength of the laser beam which is used.